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B6A AC91 AK
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EP 0742533 A1 EP 0702325 A1 WO 97/31334 A1
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(54) Abstract Title

Manufacture of combined carrier card and minichip card by two-stage molding

(57) A carrier card 2 with a removable minichip card 3 having an integrated circuit for use in mobile phone systems are manufactured in a two-stage molding process wherein the minichip card is injection molded from a first polymer (polypropylene) and then the carrier card is injection molded from a second polymer (ABS) having a lower softening temperature so as to encapsulate the minichip card. The minichip card is a form fit in a window of the carrier card by means of interengaging edges 7,9.

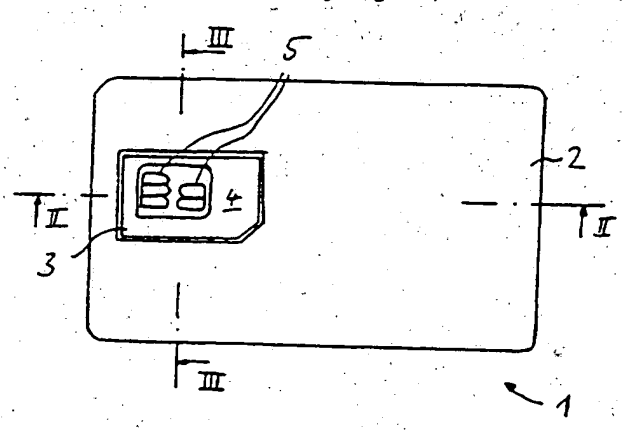

Fig. 1

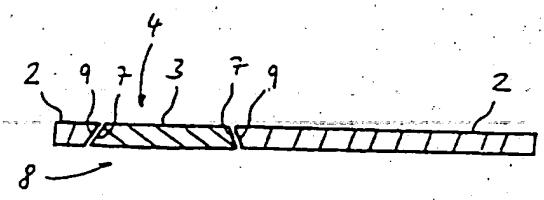

Fig. 2

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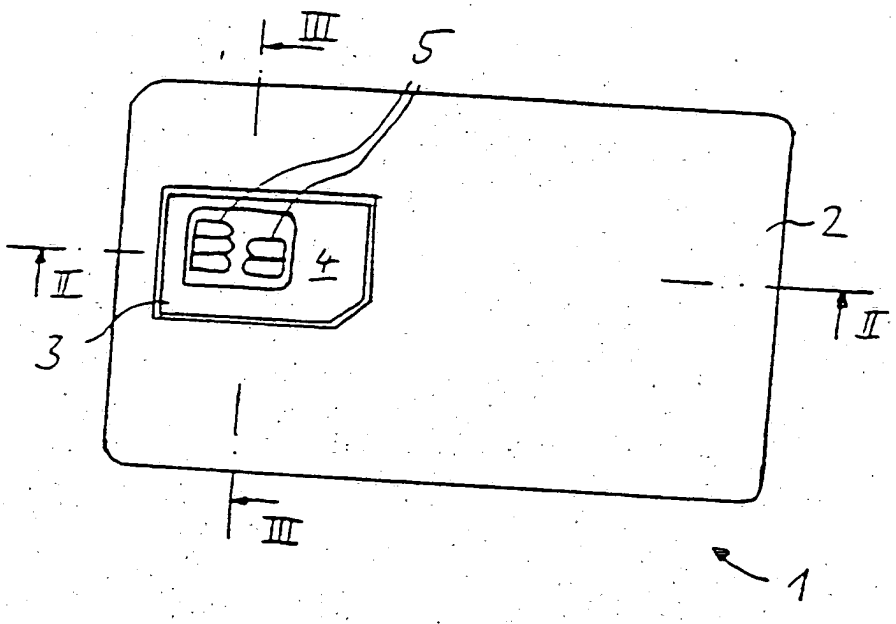

Fig. 1

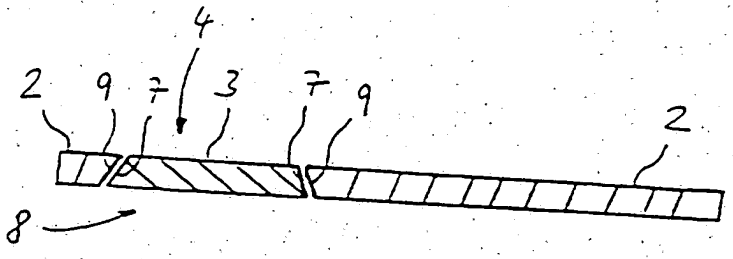

Fig. 2

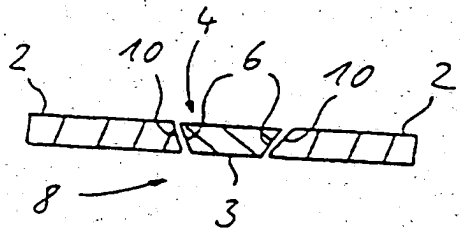

Fig. 3

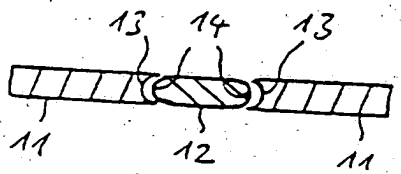

Fig. 4

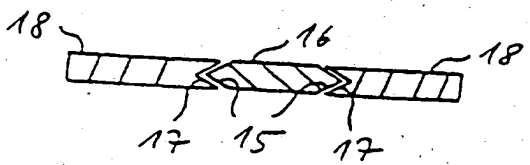

Fig. 5

Method of producing data carriers

The invention relates to a method of producing data carriers according to the preamble of patent claim 1.

Data carriers comprising a carrier card and a minichip card, which is embedded in the latter and has an integrated circuit, are used, for example, as phone cards, health insurance cards, as identification and access authorization cards for mobile radio systems, such as for example GSM telephones, or as credit or cash cards. In GSM telephones, two types of so-called GSM cards can be used. For a first mobile phone system, use is made of a card the size of a credit card (full-size card), the dimensions of which (85 × 54 mm) correspond to the dimensions of the carrier card. Customary for a second type of mobile phone system are small cards (plug-in modules) which, as a minichip card with the usual dimensions of 25 × 15 mm, can be inserted into the mobile phones. On the other hand, the integrated circuits (chips) securely mounted on both types of card have the same dimensions and electronic function. In order that both mobile phone systems can be used with the aid of a single card, it is known to connect the minichip card detachably to a recess of the carrier card provided for the purpose. For example, the minichip card may be held with a form fit in a pocket-like receptacle of a carrier card, see DE 44 19 073 A1. DE 295 04 946 U1 discloses a carrier card which has in the region of a recess provided for the minichip card a layer of adhesive tape, so that, on the one hand, the minichip card is adhesively bonded to the carrier card for use of one of the mobile phone systems. On the other hand, by removing the minichip card, it can be used for use of the other mobile phone system. To produce the abovementioned data carriers, it is usual to produce the carrier card on the one hand and the minichip card on the other hand in two separate method steps, by the injection-molding technique for example,

and thereafter connect them to each other by a form fit or by adhesion.

EP 0 495 216 B1 discloses a data carrier in which there are punched clearances and a straight notch, the minichip card being easy to remove from the carrier card by swinging it about the hinge-like notch.

The object of the present invention is to provide a low-cost method of producing data carriers which is quick and reliable and ensures that the minichip card can be easily removed from or inserted into the carrier card, the inserted minichip card being held securely in the carrier card.

To achieve the object, the invention has the features of patent claim 1.

The special advantage of the invention is, in particular, that a carrier card with a minichip card held in it with a form fit is produced in one method step. The data carrier thus formed does not need to be subsequently reworked in its form. This forms the basis of the basic idea of the invention - that of producing the minichip card and the carrier card from different materials, the first component, for example the minichip card, being produced at a first, higher temperature and the second component, for example the carrier card, being produced subsequently, at a lower temperature, in one and the same mold. The fact that the first component is already in its final form when the second component is produced means that the second component can be produced in such a way that it is adapted to the form of the first component. As a result, the first component is advantageously used as a molding element of the mold, so that, for example, undercuts of the second component are made possible in a simple way.

According to a refinement of the invention, the minichip card and the carrier card are produced in one and the same injection mold from different polymer materials, each with a different softening temperature. In a first sub-step, the minichip card, for example, is

formed as the first molded part from a first polymer material of a higher softening temperature. In a second sub-step, a second polymer material of a lower softening temperature is introduced into the mold, so that the carrier card is formed as the second molded part by "encapsulation" of the minichip card. Since the working temperature of the second molded part is lower than the softening temperature of the first molded part, the two molded parts lie one against the other with essentially no gaps, so that, if the mutually oriented contours of the molded parts are shaped appropriately, the minichip card embedded in the recess of the carrier card is held captively in the carrier card. The upper side and underside of the minichip card finish flush with the corresponding upper side and underside of the carrier card, so that troublefree subsequent treatment of the surface of the data carrier is made possible.

Further advantages of the invention emerge from the further subclaims.

Exemplary embodiments of the invention are explained in more detail below with reference to the drawings, in which:

Figure 1 shows a plan view of a data carrier with a carrier card and a minichip card embedded in the latter,

Figure 2 shows a longitudinal section through the data carrier along the line II-II according to Figure 1,

Figure 3 shows a cross section through the data carrier along the line III-III according to Figure 1,

Figure 4 shows a cross section through a data carrier according to a second exemplary embodiment and

Figure 5 shows a cross section through a data carrier according to a third exemplary embodiment.

Figure 1 shows a plan view of a data carrier 1, which comprises a carrier card 2 the size of a credit card and a minichip card 3 embedded in the latter. The

form and size of the carrier card 2 and of the minichip card 3 are standardized.

The minichip card 3 has on its upper side 4 a plurality of contact areas 5, which are connected via electrical connecting lines (not shown) to an integrated circuit (chip) arranged inside the minichip card 3.

As can be seen from Figure 2 and Figure 3, the minichip card 3 is held by its opposite longitudinal sides 6 and narrow sides 7 with a form fit in a recess or in a receiving window of the carrier card 2. In this case, the narrow sides 7 are respectively formed such that they diverge from each other from the upper side 4 to the underside 8, while the longitudinal sides 6 are formed such that they converge in the direction of the underside 8. The narrow sides 9 and longitudinal sides 10 of the carrier card 2, which surround the minichip card 3, are formed such that they correspond to the narrow sides 7 and the longitudinal sides 6.

As Figure 2 and Figure 3 clearly show, these narrow and longitudinal sides 6, 7, 9, 10 are in each case of a trapezoidal design in cross section, an inverse orientation existing between the narrow sides 7, 9 and the longitudinal sides 6, 10. This ensures reliable fixing of the minichip card 3 in the carrier card 2, it being possible by bending or tilting the carrier card 2 with respect to the minichip card 3 for the latter to be pressed out from or re-inserted into the receiving window. Consequently, use of a first mobile phone system with the carrier card 2 and the embedded minichip card 3, on the one hand, and of a second mobile phone system just using the minichip card 3, on the other hand, in any desired sequence and independently of each other is ensured. Even when only using the mobile phone system which can be used just with the minichip card 3, after use of the mobile phone the minichip card 3 can be re-inserted into the receiving window of the carrier card 2 to store it.

The data carrier 1 described above is preferably produced by injection molding in a single injection-molding operation. In this case, the molded parts comprising the carrier card 2 and the minichip card 3 are produced one immediately after the other within one injection-molding operation of a two-component injection-molding machine. Optionally, the carrier card 2 or the minichip card 3 may be produced first. If, for example, the minichip card 3 is to be molded in a first sub-step, the electronic components are placed into a corresponding injection mold and are encapsulated in a first polymer compound. After curing of the first polymer compound, the elements of the mold forming the longitudinal sides 6 and the narrow sides 7 are moved out in the transverse direction to the extent that their arrangement then establishes the outer peripheral dimensions of the carrier card 2. In a second sub-step, a second polymer compound is then injected into the then-enlarged mold, this second polymer compound having a lower softening temperature than the first polymer compound. The molding of the carrier card 2 takes place at a lower temperature than the temperature during the molding of the minichip card 3, so that the carrier card 2 is molded without an intimate bond occurring between the carrier card 2 and the minichip card 3. The narrow sides 9 and the longitudinal sides 10 form, these sides bearing with their full surface area against the narrow sides 7 and the longitudinal sides 6, respectively, of the minichip card 3. After curing of the second polymer compound, the mold may be opened, and the clamped together molded parts, namely the carrier card 2 and the minichip card 3, can then be removed. They can then together undergo further treatments, in particular a surface treatment.

The carrier card 2 and the minichip card 3 are formed from different polymer materials, in particular of a thermoplastic polymer, which differ in that they have a different softening temperature. The minichip card 3 is preferably produced from polypropylene and

the carrier card 2 is preferably produced from ABS (acryl-butadiene styrene). For a polypropylene molding compound, the processing temperatures for injection molding lie in the range from 250° to 270°. The processing temperatures of ABS lie in the range from 180° to 280°. By suitable choice of the polypropylene and the ABS material, it is consequently possible to find two polymer compounds of which the processing and softening temperatures are sufficiently far apart from each other for them to be processed according to the invention.

Alternatively, the mold may be designed such that the longitudinal and narrow sides of the carrier card 2 and minichip card 3 have different contours. For example, a carrier card 11 and a minichip card 12 may respectively have cross-sectionally arcuate longitudinal sides 13 and 14 and narrow sides. As Figure 4 clearly shows, the longitudinal sides 14 of the minichip card 12 are curved outward, bearing with a form fit against the inwardly curved longitudinal sides 13 of the carrier card 11. The degree of curvature establishes the flexural loading when the minichip card 12 is pressed out from or inserted into the carrier card 11.

According to a further exemplary embodiment as shown in Figure 5, at least two sides, in particular longitudinal sides 15, of a minichip card 16 may be of a wedge-shaped design. These bear with their full surface area against corresponding longitudinal sides 17 of a carrier card 18, which are respectively designed as tapering grooves. The angle of the wedge or the groove establishes the flexural forces required for pressing out or inserting the minichip card 16. Alternatively, any other contours of the receiving window or the minichip card, which may depend on the respective application, can be produced.

CLAIMS

1. A method of producing data carriers having in each case a carrier card and a minichip card, which can be removed from the carrier card and has an integrated circuit, wherein the minichip card and the carrier card are formed in one method step from different materials in such a way that the minichip card is held in a receiving window of the carrier card by the latter with a form fit, while avoiding materials bonding with the carrier card.

2. The method as claimed in claim 1, wherein the minichip card is formed by heating a first polymer compound under pressure at a temperature above the softening temperature of a second polymer compound, serving for molding the carrier card, or vice versa.

3. The method as claimed in claim 1 or 2, wherein, in a first sub-step, the minichip card is formed from the first polymer compound with a first softening temperature and, in a second sub-step, the carrier card is produced from the second polymer compound, having a second softening temperature which is lower than the first, in one and the same mold.

4. The method as claimed in any one of claims 1 to 3, characterized in that the minichip card and the carrier card are in each case produced as a one-piece molded part in one and the same injection mold, a first molded part being produced in a first sub-step and a second molded part being produced in a second sub-step at a temperature below the softening

temperature of the first molded part, so that the mutually oriented contours of the molded parts bear directly against one another.

5. The method as claimed in any one of claims 1 to 4, wherein the outer contours (e.g. longitudinal side 6, 14, 15; narrow side 7) of the minichip card are formed such that they complement the inner contours (e.g. narrow side 9; longitudinal side 10,13, 17) of the carrier card.

6. The method as claimed in any one of claims 1 to 5, wherein the carrier card and the minichip card are produced from a thermoplastic material.

7. The method as claimed in claim 6, wherein the minichip card is produced from a polypropylene material and the carrier card is produced from an ABS polymer material.

8. Use of the data carriers obtainable by the method as claimed in claims 1 to 7 for producing mobile phone cards.

9. A method of producing data carriers substantially as described herein with reference to the accompanying drawings.

The Patent Office

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Application No: GB 9801104.2 **Examiner:** Graham Russell
Claims searched: 1-9 **Date of search:** 28 April 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): B6A (AK)

Int Cl (Ed.6): G06K 19/077

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	EP 0742533 A1	(SCHLUMBERGER) see column 3 line 50 - column 4 line 7	1
A	EP 0702325 A1	(FABRICA NACIONAL DE MONEDA) see column 3 lines 24-38	1
A	WO 97/31334 A1	(ORGA KARTENSYSTEME) see abstract	1
A	WO 96/36009 A1	(NATIONAL WESTMINSTER BANK) see page 2 line 23 - page 3 line 20	1

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Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.